CLAIMS

What is claimed is:

1. A method for automatically removing noise comprising the steps of:

a) receiving a current pixel;

b) computing an activity metric of the current pixel by using the current pixel and a neighborhood of pixels related to the current pixel;

c) computing a distance metric for indicating the likelihood that the current pixel is a background pixel by using the activity metric and at least one background parameter; and

d) modifying the current pixel based on the distance metric;

wherein the distance metric provides a soft thresholding framework.

2. The method of claim 1 further comprising the steps of:

updating the background parameter based on the current pixel;

wherein the updated background parameter is employed to compute the distance metric for the next current pixel.

3. The method of claim 1 wherein the current pixel includes a luminance component and a chrominance component; and wherein the step of computing an activity metric of the current pixel by using the current pixel and a neighborhood of pixels related to the current pixel includes:

computing a local activity based on the luminance component of the current pixel; and

computing the activity metric based on the local activity.

4. The method of claim 1 wherein the current pixel includes a luminance component and a chrominance component; and wherein the step of computing a distance metric for indicating the likelihood that the current pixel is a background pixel by using the activity metric and at least one background parameter includes:

computing a square of a normalized Euclidean distance based on the luminance component and a chrominance component of the current pixel; and

generating a sum of the square of a normalized Euclidean distance and an expression that includes the activity metric.

5. The method of claim 1 wherein the current pixel is represented by an *L* component, an *a* component, and a *b* component; and wherein the step of modifying the current pixel based on the distance metric includes:

generating a modified *L* component based on the current *L* component and the distance metric;

generating a modified *a* component based on the current *a* component and the distance metric; and

generating a modified *b* component based on the current *b* component and the distance metric.

6. The method of claim 1 wherein the method is applied in a luminance-chrominance color space.

7. The method of claim 6 wherein the luminance-chrominance color space is one of a CIELab color space and YCrCb color space.

8. The method of claim 1 wherein the step of receiving a current pixel includes:

scanning a current line of pixels that includes the current pixel; and

scanning one of at least a first line of pixels above the current line and a second line of pixels below the current line.

9. The method of claim 4 wherein the step of computing an activity metric of the current pixel by using the current pixel and a neighborhood of pixels related to the current pixel includes:

computing an activity metric of the current pixel based on the current pixel and a square window of pixels that are centered around the current pixel.

10. The method of claim 1 wherein the step of modifying the current pixel based on the distance metric includes:

adjusting the current pixel value based on the probability that the current pixel is a background pixel.

11. The method of claim 10 wherein the step of adjusting pixel value based on probability that a pixel is a background pixel includes the step of

adjusting the pixel value by an amount that is based on the probability.

12. The method of claim 10 wherein the activity metric is used to distinguish between a background pixel and a halftone pixel.

13. The method of claim 1 further comprising the step of:

using the activity metric to detect light values that are part of a scanned halftone region;

selectively not affecting the light values that are part of the scanned halftone region; and.

selectively modifying the pixel values that are not part of the scanned halftone region.

14. A method of processing a document comprising the steps of:

a) constructing a parallelepiped having boundaries in luminance and chrominance space to specify an expected background color;

b) automatically adjusting the boundaries of the parallelepiped as a scan proceeds; and

wherein the method selectively adapts the background color based on the pixel values of the document being processed.

15. The method of claim 14 further comprising the step of:

determining the probability that a current pixel is a background pixel based on the boundaries of the parallelepiped.

16. The method of claim 14 wherein the method is applied in a luminance-chrominance color space.

17. The method of claim 16 wherein the luminance-chrominance color space is one of a CIELab color space and YCrCb color space.

18. A computer-implemented method for automatically removing background pixels comprising the steps of:

a) receiving a current pixel;

b) determining a probability that the current pixel is a background pixel based on a dynamic background threshold;

c) modifying the current pixel based on the probability that the current pixel is a background pixel; and

d) updating the dynamic background threshold based on the current pixel and the background threshold.

19. The method of claim 18 wherein determining a probability that the current pixel is a background pixel based on a dynamic background threshold includes the steps of

computing the probability that the current pixel is a background pixel by using a sliding window of pixels that are neighbors of the current pixel;

wherein the method is a single pass approach that does not require a pre-scan.

20. The method of claim 18 wherein the method is applied in a luminance-chrominance color space that is one of a CIELab color space and YCrCb color space.